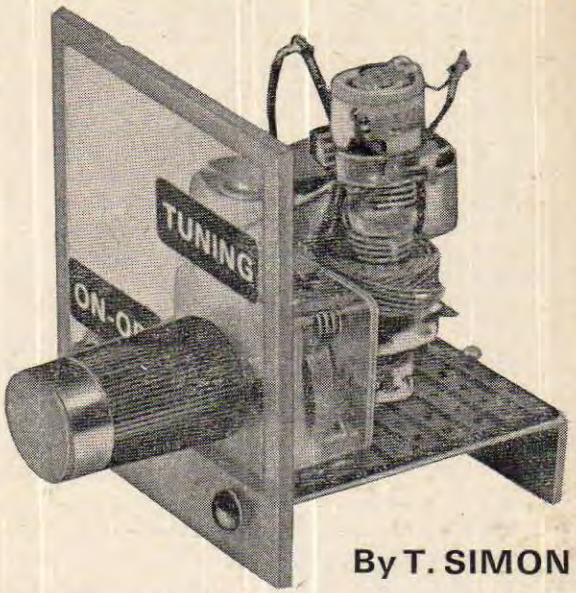
3 SIMPLE RECEIVERS FOR Beginners

TWO TRANSISTOR

NUMBER TWO . . . *in our beginner's series gives details for building a dual function two transistor receiver. It uses the minimum number of components —note that there are no resistors or coupling capacitors.*

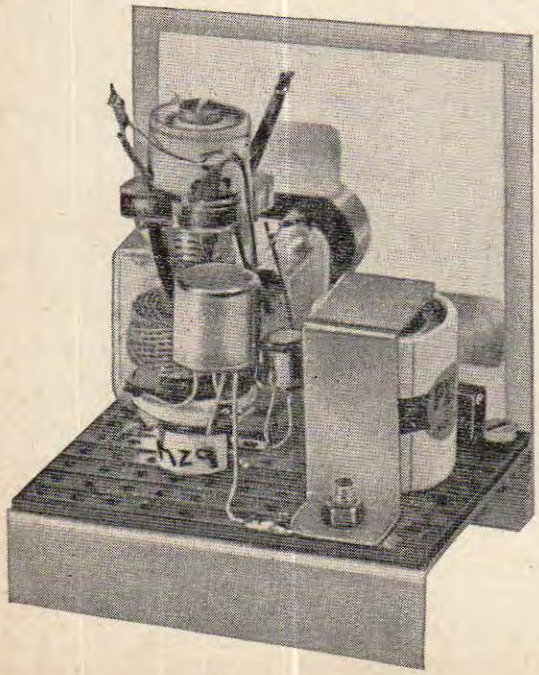


By T. SIMON

LAST month, in part one of this short series, a receiver was described which used only one transistor plus two diodes in a reflex circuit. The second receiver, shown here, uses two transistors in a complimentary direct-coupled circuit. Although this sounds rather a mouthful it boils down to super-simple circuitry and practically no components. There are no resistors and no fixed capacitors and, unlike last month's circuit, no separate diodes for detection either.

Dual-function

One great advantage of this little receiver is that when the battery switch is off, the receiver will function as a crystal set. In areas of good signal strength, say for a local station, the switch can be left in the off position thus saving the battery.



Switching the battery into circuit boosts the signal very considerably. At the writer's home, a small transistor output transformer, connected in place of the headphones, allowed a small speaker to give very good results from the local station at Brookmans Park on medium waves.

Selectivity

Although the set has only one tuned circuit, separation of stations was easily possible and no overlap was detected. This is probably due to the very high "Q" of the coil which aids the selectivity of the receiver. Normally, with 150ft. of wire for an aerial, both BBC1 and BBC4 tend to tune in together on a crystal receiver with a home wound coil. This is at the writer's home in St. Albans. In other locations things might be better or worse, however, with such a large aerial, it speaks well for the selectivity

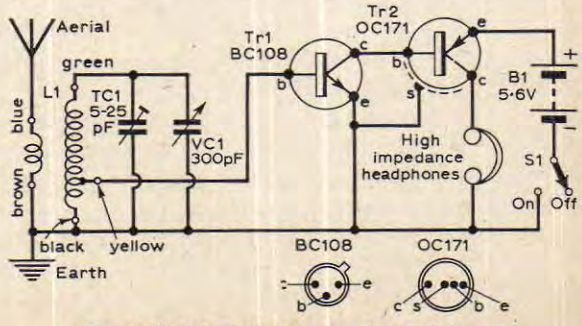


Fig. 1: Circuit of the two transistor receiver.

of the receiver at being able to separate the stations so easily and successfully.

Referring to the circuit shown in Fig. 1. The aerial is connected to the coupling winding on the coil L1. The signal is thus inductively coupled to the main tuned winding, and from here is fed to the base of the first transistor Tr1 via a low impedance tap on the coil. Transistor Tr1 is directly coupled to the second transistor, Tr2, in whose collector lead the headphones are connected. With the battery switched off, Tr1 functions as a diode feeding the signal to the base of Tr2. This second transistor might be considered as acting as a collector load for Tr1.

Polarity

Note that Tr1 is a p-n-p type whereas Tr2 is an n-p-n type. This is important for the circuit to function. The battery is connected in such a way as to supply power in the correct polarity to both transistors. The emitter of Tr2 goes to the positive side of the battery which is normal for a p-n-p transistor. While the emitter of Tr1 connects, via the on/off switch, to the negative terminal of the battery. With the battery switched off, the diode action of the junctions of the transistors allows the circuit to function as a simple crystal receiver. With the battery switched on, the circuit will amplify the signal quite considerably. In this respect it is possible that too

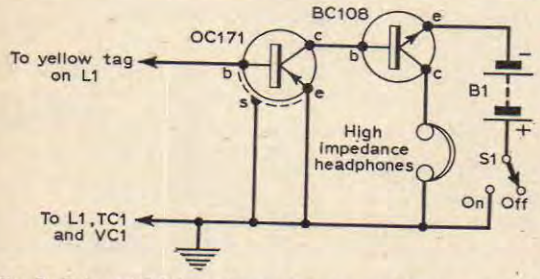


Fig. 2: Tr1 and Tr2 interchanged, but note battery polarity.

much amplification will be present for the strength of signal entering the set. This will be characterised by distortion due to clipping of the signal waveform. The solution is to use a smaller and/or perhaps a less efficient aerial. Or, if one signal is very loud while a more distant one much lower in strength, then the receiver could be used as a crystal set for the very strong signal, thus conserving the battery and avoiding the clipping referred to.

Results with the prototype were excellent using a pair of high resistance headphones (2000Ω), a good earth, and 150ft. of aerial wire. Very good results were also obtained from 40ft. of aerial wire with the same earth.

Construction

Construction is very simple but it is important to make sure of the connections to the transistors bearing in mind that one is p-n-p and the other n-p-n. The transistor used for Tr1 might be considered a strange choice since these are usually thought of as useful for audio applications and not r.f. However, the maker's specifications give the F_T of the BC108 as 150Mc/s typical, and thus it would appear well suited to medium wave circuitry.

For those who would like to experiment, it is possible to turn the circuit round and use the OC171

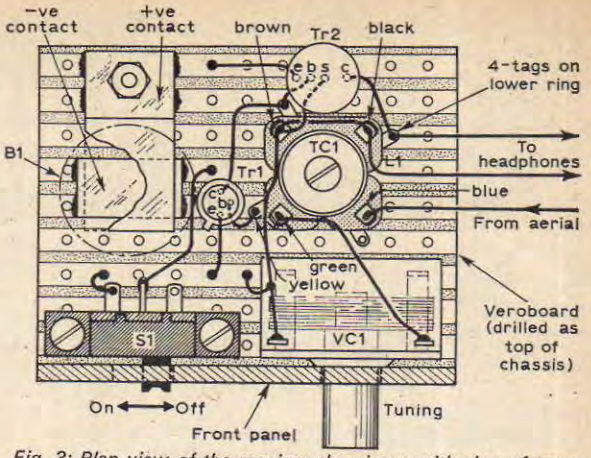


Fig. 3: Plan view of the receiver showing positioning of components and the wiring. Note that there is a lower ring of tags on the coil.

in the Tr1 position, and the BC108 in the audio stage. This circuitry is shown in Fig. 2, again the only points to note are the correct connection of the transistors with regard to polarity.

Chassis

The chassis is bent from a small scrap of aluminimum and drilled as shown in Fig. 4. The front panel was made from a piece of thin Perspex which was to hand. Cut and drill as shown in Fig. 4. *Note:* Perspex cracks very easily so be very careful when drilling and filing.

The piece of Veroboard is used mainly as something to solder to. It is held to the chassis by the various bolts and also the coil. The tuning capacitor was glued to the Veroboard with Evostick applied along its bottom edge only. The coil mounts in the hole drilled and is held in position by its own threaded plastic nut supplied. The on/off switch

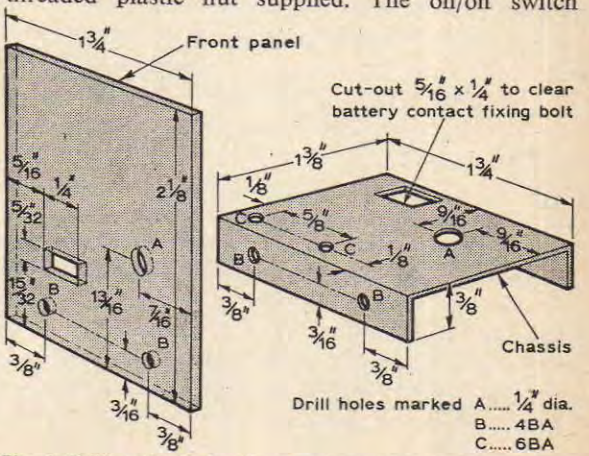


Fig. 4: Drilling details for the chassis and front panel. Note—these details might alter with differing components. Check sizes etc., first before drilling.

needs two 8BA nuts and bolts which may be purchased from most good ironmongers in a small plastic pack containing half a dozen. These bolts may need to be cut down if they are too long.

The battery is a special Mallory type which is rated at 5·6 volts. It is clipped into position with a

small piece of springy brass, perhaps taken from an old cycle lamp battery? This is bent to shape and bolted to the chassis. Note that there is a hole cut out in the chassis so that this bolt does not short the battery to the aluminium.

Wiring

When all components are mounted wiring up can commence, but do not bolt the front panel on yet. It is all too easy to touch it with a hot soldering iron with gruesome results. Wiring should be carried out to conform with Fig. 1 and Fig. 3. Use a pair of pliers as a heat shunt when soldering in the transistors. Leave clipping in the battery until the very last. Immediately prior to this, check again the connections to the transistors, remember that connecting the battery in the wrong way will almost certainly destroy these devices. Check if you have used the alternative circuit shown in Fig. 2, if so have you orientated the battery correctly?

Testing

Connect the headphones to the collector of Tr2 and earth, clip on aerial and earth leads but *do not* switch on the battery. Tune VC1 from max to min and see if you can hear any stations. If you have ever built a crystal set and got it working in your area, then it is almost certain that this receiver will pick up the station(s). If you can receive more than one station, tune in to the weakest one and switch in the battery. The signal should be boosted quite appreciably. Having got the receiver working satisfactorily, you might like to try experimenting with the aerial. Try the bedsprings—mine work quite well with the battery switched in and no earth at all!

There is no point in increasing the battery voltage since this will not increase the signal level to any significant degree. You might consider building a small case for the receiver for which almost any material would be suitable—plastic, wood etc.

The coil shown in the photographs has its own "built-in" trimmer. This is not really required in this circuit and thus it should be ignored. It does not require any adjustment at all.

NUMBER THREE . . . next month—a simple three transistor superhet receiver with a reflexed i.f. stage, and its own miniature 1in. speaker.

★ components list

Transistors:
Tr1 BC108 Mullard
Tr2 OC171 Mullard

Coil:
L1 StabQoil type TMZ9 complete with trimmer TC2 (Electroniques)

Capacitors:
VC1 300pF midget solid dielectric

Miscellaneous:
Battery—5·6V Mallory type PX23; midget on/off slide switch (G. W. Smith); high impedance headphones (2000–4000Ω); small piece veroboard 1¾ x 1⅜in. (nine strips); aluminium for chassis 2⅛ x 1¾in.; piece thin Perspex 1¾ x 2⅛in.; strip of brass ⅜ x 1½in.; three 8BA nuts and bolts; two 6BA nuts and bolts; wire; solder; aerial and earth wire.